mactec-ers
MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

**Log Event** A

# Borehole 50-04-08

## Borehole Information

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|---|---|---|---|---|---|
| **Farm :** | T | **Tank :** | T-104 | **Site Number :** | 299-W10-148 |
| **N-Coord :** | 43,527 | **W-Coord :** | 75,685 | **TOC Elevation :** | 673.00 |
| **Water Level, ft :** | 94 | **Date Drilled :** | 1/31/1975 | | |

### Casing Record

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|---|---|---|---|---|---|
| Type : | Steel-welded | Thickness, in. : | 0.237 | ID, in. : | 4 |
| Top Depth, ft. : | 0 | Bottom Depth, ft. : | 95 | | |
| Type : | Steel-welded | Thickness, in. : | 0.280 | ID, in. : | 6 |
| Top Depth, ft. : | 0 | Bottom Depth, ft. : | 100 | | |

**Cement Bottom, ft. :** 95 **Cement Top, ft. :** 0

**Borehole Notes:**

Borehole 50-04-08 was drilled in January 1975 to a depth of 100 ft with 6-in. casing. In February 1981, the 6-in. casing was perforated from 0 to 20 ft and 93 to 95 ft. A 4-in. casing liner with a metal cap welded on the bottom was positioned inside the 6-in. casing to a depth of 95 ft. The open borehole below the bottom of the 4-in. casing and the entire annulus between the 4-in. and 6-in. casings was filled with grout. The thicknesses of the 4-in. and 6-in. casings are presumed to be 0.237 in. and 0.280 in., respectively, on the basis of the published thickness for schedule-40, 4-in. and 6-in. steel tubing.

## Equipment Information

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|---|---|---|---|---|---|
| **Logging System :** | 1B | **Detector Type :** | HPGe | **Detector Efficiency:** | 35.0 % |
| **Calibration Date :** | 10/1997 | **Calibration Reference :** | GJO-HAN-20 | **Logging Procedure :** | MAC-VZCP 1.7.10-1 |

## Logging Information

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|---|---|---|---|---|---|
| **Log Run Number :** | 1 | **Log Run Date :** | 05/22/1998 | **Logging Engineer:** | Alan Pearson |
| **Start Depth, ft.:** | 0.0 | **Counting Time, sec.:** | 200 | **L/R :** L **Shield :** | N |
| **Finish Depth, ft. :** | 6.0 | **MSA Interval, ft. :** | 0.5 | **Log Speed, ft/min.:** | n/a |

| | | | | | |
|---|---|---|---|---|---|
| **Log Run Number :** | 2 | **Log Run Date :** | 05/26/1998 | **Logging Engineer:** | Alan Pearson |
| **Start Depth, ft.:** | 5.0 | **Counting Time, sec.:** | 200 | **L/R :** L **Shield :** | N |
| **Finish Depth, ft. :** | 44.0 | **MSA Interval, ft. :** | 0.5 | **Log Speed, ft/min.:** | n/a |

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|---|---|---|---|---|---|
| **Log Run Number :** | 3 | **Log Run Date :** | 05/27/1998 | **Logging Engineer:** | Alan Pearson |
| **Start Depth, ft.:** | 43.0 | **Counting Time, sec.:** | 200 | **L/R :** L | **Shield :** N |
| **Finish Depth, ft. :** | 78.0 | **MSA Interval, ft. :** | 0.5 | **Log Speed, ft/min.:** | n/a |

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|---|---|---|---|---|---|
| **Log Run Number :** | 4 | **Log Run Date :** | 05/28/1998 | **Logging Engineer:** | Alan Pearson |
| **Start Depth, ft.:** | 95.5 | **Counting Time, sec.:** | 200 | **L/R :** L | **Shield :** N |
| **Finish Depth, ft. :** | 77.0 | **MSA Interval, ft. :** | 0.5 | **Log Speed, ft/min.:** | n/a |

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|---|---|---|---|---|---|
| **Log Run Number :** | 5 | **Log Run Date :** | 05/28/1998 | **Logging Engineer:** | Alan Pearson |
| **Start Depth, ft.:** | 75.0 | **Counting Time, sec.:** | 200 | **L/R :** L | **Shield :** N |
| **Finish Depth, ft. :** | 60.0 | **MSA Interval, ft. :** | 0.5 | **Log Speed, ft/min.:** | n/a |

**Logging Operation Notes:**

This borehole was logged by the SGLS in five log runs using a 200-s counting time. Four log runs were required to log the borehole. An additional log run was performed to repeat an interval of the borehole as a quality check. The top of the borehole casing, which is the zero reference for the SGLS, is approximately flush with the ground surface. The total logging depth achieved was 95.5 ft.

## Analysis Information

Analyst : A.W. Pearson

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 08/25/1998

**Analysis Notes :**

The pre-survey and post-survey field verification for each logging run met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the accepted calibration spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

This borehole was completed with 4-in.- and 6-in.-diameter casings along the entire logged interval. A casing correction factor for a 0.50-in.-thick steel casing was applied to the concentration data because it most closely matched the 0.517-in. total combined thickness of the 4-in. and 6-in. casings. The entire annulus between the 4-in. and 6-in. casings is filled with grout, making it impossible to produce accurate radionuclide assays. However, man-made and natural radionuclides were identified and apparent concentrations are reported.

Approximately 2 ft of water has collected inside the bottom of this borehole. The appropriate water correction factor was not available, so no compensation was applied, resulting in lower man-made and natural radionuclide concentration values along the water-filled interval.

**Log Plot Notes:**

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides

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can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

The interval between 60 and 75 ft was relogged as a quality assurance measure to establish the repeatability of the radionuclide concentration measurements made by the SGLS at that time. The radionuclide concentrations were calculated using separate data sets provided by the original and rerun logging runs. A plot comparing the two data sets is included.

A time-series plot is included that shows the maximum gross gamma count rate in the 65- to 70-ft depth range between 1975 and 1993. Portions of the declining gross gamma activity over time are compared to the calculated decay curves for specific radionuclides.

Plots of representative historical gross gamma log data collected between 1975 and 1993 are also included.

**Results/Interpretations:**

The radionuclide concentrations identified in this borehole are underestimated and reported as apparent concentrations only.

The man-made radionuclides Cs-137 and Co-60 were detected by the SGLS. The Cs-137 contamination was detected continuously from the ground surface to 14.5 ft. Isolated occurrences of Cs-137 were detected from 18.5 to 19 ft, 22 to 22.5 ft, and at 86.5 ft. The Co-60 contamination was detected continuously from 67.5 to 81 ft. Co-60 contamination was also detected near the bottom of the borehole from 92.5 to 93.5 ft and 95 to 95.5 ft.

The K-40 concentration values increase from 37.5 to 39 ft and remain elevated to a depth of 48.5 ft. Elevated K-40 and Th-232 concentrations occur from 84 to 91 ft. Sharply decreased K-40 and Th-232 concentrations were detected between 91 ft and the bottom of the logged interval (95.5 ft).

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Reports for tanks T-104 and T-105.